BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

Application for Net Metering Tariff
Rate Schedule 1289

Submission to the
British Columbia Utilities Commission

November 2003

IN THE MATTER OF the Utilities Commission Act (the "Act"), R.S.B.C. 1996, c. 473, as amended

AND IN THE MATTER OF an Application by British Columbia Hydro and Power Authority for approval of a Net Metering Rate

TO: British Columbia Utilities Commission
600 – 900 Howe Street
P.O. Box 250
Vancouver, B.C. V6Z 2N3

APPLICATION

British Columbia Hydro and Power Authority ("BC Hydro") hereby applies, pursuant to the Utilities Commission Act (the "Act") and, in particular, to Section 61 thereof, for an order of the British Columbia Utilities Commission (the "Commission") to approve:

(1) Net Metering Rate Schedule 1289 (the "Rate Schedule 1289" or "RS 1289", Tab B);

(2) Revisions to the BC Hydro Electric Tariff Index to include reference to new Rate Schedule 1289 (Tab C);

(3) The Net Metering Interconnection Agreement, Electric Tariff Supplement No. 63 (the "Agreement" or "TS No. 63", Tab D);

Supporting documentation for this Application, including the terms and conditions associated with this initiative, is included as Tab A.

Attached as Tab F, Appendix 3, for information only, is the document "Net Metering Interconnection Requirements, 50 KW and Below" which is applicable for those customers wishing to use RS 1289.

BC Hydro will implement RS 1289 upon approval from the Commission and respectfully requests from the Commission the timely approval of the tariff Rate Schedule 1289 (Tab B), the index page (Tab C), and Tariff Supplement No. 63 (Tab D).

All of which is respectfully submitted.

Dated at Vancouver, British Columbia, this ___ day of November, 2003.

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

Per:

_____

Richard Stout

Chief Regulatory Officer

Communications with respect to this Application should be sent to:

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Tab A

NET METERING TARIFF DISCUSSION

BACKGROUND

The British Columbia provincial government recently released its energy plan in *Energy Plan for Our Future: A Plan for BC* (November 2002). Policy Action #20 of the plan states that BC Hydro, Aquila Networks, and other investor-owned utilities will develop policies such as net metering and interconnection standards to achieve a voluntary goal to acquire 50% of new supply from BC Clean Electricity over the next 10 years.

On June 27, 2003, BC Hydro submitted a report to the British Columbia Utilities Commission entitled *Net Metering in British Columbia*, a white paper prepared by Compass Resource Management Ltd.. BC Hydro also provided its own conclusions and submitted written comments on the report, and on net metering in general, from various interest groups and individuals.

The British Columbia Utilities Commission, in Letter No. L-37-03 to BC Hydro dated July 22, 2003, recommended that BC Hydro develop and implement a net metering tariff. The Commission provided the following parameters for the net metering tariff:

- It should be available to the residential and commercial classes.
- It should be applicable only to clean energy projects, as defined in the BC Government's Energy Policy.
- It should be applicable to generation of 50kW or less.
- Interconnection must be safe, but the rules governing interconnection should not be extensive, or burdensome in administrative process.
- BC Hydro should consult with other agencies and interest groups as appropriate.
- Customer generation should be limited to own use only at the registered location of the net metering installation. In determining consumption charges,

net excess generation may be banked as a credit to the customer's account to be applied against future net consumption.

- BC Hydro should propose a rate for purchase of net excess generation on a given anniversary date.

The following outlines some of the details of BC Hydro's proposed net metering tariff.

DEFINITIONS AND PROGRAM CONCEPT

Net metering promotes small-scale, grid-connected generation at homes and businesses. It allows customers with distributed generation to "bank" their excess generation, increasing the value they derive from their on-site generation. In the absence of a net metering policy, customers with generation would need to install smaller systems and/or electricity storage devices to capture excess generation for use when generation exceeds consumption.

The objective of the proposed net metering tariff is to provide customers with the means to take responsibility for their own power production and to lower their environmental impact, consistent with Policy Action #20, of the BC government Energy Plan.

An alternative to net metering is net billing. Under net billing, customers pay retail rates for their net or gross consumption and they receive a price different than the retail rate for their net or gross electricity production. BC Hydro has chosen not to use net billing.

Under the simplest version of net metering, there is a single meter that runs backwards when the distributed generator produces more electricity than it requires and runs forward when the distributed generator produces less than it requires. Distributed generators are only billed for their positive "net

consumption", which is defined as their total consumption minus their total generation in a given billing cycle, as shown by a positive meter reading. Distributed generators who have generated more than they have consumed in a given billing cycle will have their meter run backwards. This amount of electrical energy will be credited to the distributed generator to use in a subsequent billing cycle. At an anniversary date, any unused credited energy will be given to or purchased by the utility.

TERMS AND CONDITIONS

Availability

The net metering program is available to residential and commercial customers in Rate Zone I and Rate Zone II.

Customers taking service under rate schedules 1101, 1107, 1200, 1201, 1210, 1211, 1220, 1234, 1255, 1256, 1265, and 1266 are eligible to subscribe to the net metering program. Zone II customers taking service under Special Contracts are also eligible provided that BC Hydro is satisfied that the metering, billing and other requirements of the net-metering tariff can be met.

Eligible customers are those that own and operate a distributed generation facility that utilises water, wind, solar, fuel cell, geothermal, biomass, or other inherently self-renewing energy source to generate electricity.

Only distributed generating facilities owned by the customer with a total capacity of no more than 50kW and located on the customer's own premises, or on an adjacent parcel of land owned or leased by the customer, are eligible under the program. Such distributed generators must operate in parallel with BC Hydro's transmission and distribution facilities.

There is no limit or program cap on participation in the proposed net metering program. However, this program feature will be reviewed if necessary after some experience has been gained with the program.

Net Metering Rate and Bill Calculation

The proposed net metering tariff overlays the existing eligible residential and commercial rate schedules.

The Basic Charge:

The basic charge in existing rates covers the meter installation cost, meter reading cost and the customer service billing cost. The equipment cost of the standard meter is capitalised and is not included in the basic charge.

Under the proposed net metering tariff, the customer will only pay one basic charge; which is the basic charge on the existing rate. However, as discussed in Section 3.3, there are incremental costs of meter installation, meter reading and billing as a result of the net metering program. Since the total costs of the program are expected to be small, BC Hydro proposes not to recover these costs from the net-metering customers through a basic charge on RS 1289, but will pass these costs onto all ratepayers.

Energy Rate:

The proposed energy rate for each billing cycle is the same energy rate(s) as found in the schedule under which the customer would normally receive service.

On-site generation is thus effectively valued at the retail energy rate for any generation that is used for the customer's own consumption. This is a common feature in simple net metering programs whereby the generation is not credited separately.

Demand Rate:

The proposed demand charge is based on the net billing demand and the demand rate in the schedule under which the customer would normally receive service. The installed meter will measure the net billing demand over the billing cycle.

Generation Account:

Each distributed generator on RS 1289 will have a generation account set up to record the excess energy generated over that consumed. The generation account will "bank" the excess energy from each billing period. This banked energy will be applied to energy delivered in later billing periods, until the anniversary date is reached.

The anniversary date occurs approximately every 12 months. The anniversary date is defined as the end of the sixth billing period, in the case of customers being billed bi-monthly, or the end of the twelfth billing period, in the case of the customers being billed monthly from the start date. The start date is the day and month when the customer first takes service under the net metering rate.

At each anniversary date, the customer's Generation Account will be set to zero and any unused energy credits in the account will be purchased by BC Hydro as discussed in "Annual Purchase of Excess Energy in Generation Account.

Net Metering Bill Calculation

The bill for each billing period under the net metering tariff is equal to:

Basic Charge + (Energy Rate × Net Energy (kWh)) + (Demand Rate × Net Billing Demand (kw))

Where,

Net Energy (kWh) = E_s - E_f - GA

E_s is the electricity supplied by BC Hydro to the customer during the period between meter reads. E_f is the electricity delivered by the customer's distributed generating facility to BC Hydro's system during the period between meter reads. GA is the amount of energy kWh in the customer's Generation Account in the current billing period, which is the absolute sum of any negative Net Energy, or sum of generation kWh credits, from previous billing periods. If there are sufficient generation kWh credits in the Generation Account, they can be used to bring the Net Energy (kWh) amount to zero. In the latter case, the customer pays only the applicable basic charge and demand charge amount, since the energy charge is applicable only if the Net Energy kWh amount is greater than zero.

If the measured Net Energy kWh amount is negative, BC Hydro will add the Net Energy kWh amount as a generation credit to the customer's Generation Account, which may be used as a kWh credit in future billing periods.

Annual Purchase of Excess Energy in Generation Account

At the anniversary date, BC Hydro will credit any remaining unused kWh in the customer's Generation Account at the Energy Price per kWh, (see next section for discussion of energy price). If the customer's usage in the previous few billing

periods is low, such that it is expected to take more than six months to credit back the customer, a cheque will be written to the customer instead. This procedure is proposed to minimise the cost of producing and mailing cheques.

Energy Price

A review of US State net metering programs (see Table 1, Tab F Appendix 1) shows that where utilities purchase any unused net excess generation, it is often purchased at avoided cost. In a few cases, it is purchased at the retail rate.

BC Hydro recommends the avoided cost approach. The retail rate approach is not recommended, as residential and commercial customers would be paid different prices, which would raise fairness concerns. Further, there is no guarantee that retail rates will reflect avoided costs in the future, and paying retail rates could cause cost-shifts to non-participating customers.

BC Hydro is proposing an Energy Price of 5.4 cents/kWh, based on the weighted average energy cost of the completed 2002/03 Green Power Generation Call for Tender. BC Hydro will review the Energy Price in future based on the BC Hydro weighted energy cost of the most recent comparable Call for Tender for energy.

Metering

The simplest approach would be to use the standard Electro-mechanical customer meter. These meters will measure the net amount of electricity consumed by the customer from the utility (meter running forwards) or the net amount of electricity produced by the customer's generation that is exported to the utility grid (meter running backwards). However, Measurement Canada does not approve these meters, nor are they calibrated, to register energy in the reverse direction (net customer generation). As such, these meters cannot be legally used for net metering.

The proposed approach is to install a "four quadrant meter" that will record both the net kWh taken from the BC Hydro system by the customer and the net kWh generated into the BC Hydro system by the customer. Currently, the incremental equipment cost of this meter ranges from $130 for a commercial kWh meter to $229 for a residential meter. The capital costs of these meters for the net-metering program will be capitalised with other standard meters and the amortisation costs will be shared among all ratepayers.

In addition to the equipment cost of the meter, there are meter installation costs and incremental meter reading costs. These costs cover changing the existing meter and also reading the four-quadrant meter. The meter reading is more costly as there is more information to collect and disseminate compared to the standard meter reading. The following table shows the incremental meter installation and meter reading costs:

Table 1:

	Residential	Commercial
1. Incremental meter install costs per net metered customer	$60	$70-$188
2. Incremental meter Reading cost		
- Initial Set up per account	$18	$18
- Reading Cost per Bill	$3	$3

The standard meter install cost is $60 for residential and $70 for most commercial accounts. A commercial bottom connected meter (kWh+kW+kVarh) with in-situ testing costs $188.

Billing

The net metering program will require special billing, which will cost more than regular billing. This will include keeping track of the customer's Generation

Account, manually checking the net metering bill and crediting the customer for any net excess generation at the customer's anniversary date.

The incremental cost of the special billing is $39 for the initial set-up per account, $10 cost per bill and $19 cost for annual reconciliation of each bill.

Interconnection Requirements

The main components of the net metering interconnection are the distributed generator energy source, power conditioning equipment (inverter or controls), and a disconnect switch.

A Net Metering facility installation is required to be consistent with the applicable standards specified in the BC Hydro technical document "Net Metering Interconnection Requirements, 50kW and Below, Rate Schedule 1289" (see attached in Tab F, Appendix 3). The BC Hydro interconnection requirements are based on the "*MicroPower* Connect Interconnection Guideline" (version 8, July 22, 2003). MicroPower Connect is an initiative supported by Natural Resources Canada through the Climate Change Action Plan 2000 funding. The objective of this initiative is to reduce barriers for the adoption of small inverter-based distributed resources (DR). The Guideline aims at easing the interconnection of inverter based DR with the existing distribution grids, while avoiding negative impact on system reliability and safety. BC Hydro participated in this initiative by having a representative on the technical committee.

BC Hydro safety practice regulations requires that the distributed generator installs an accessible, load-break disconnect switch, lockable in the open position with a visible break, near the utility meter.

A Local Operating Order (LOO) will be required to define the switching authority boundary and the procedure for either party to obtain a Guarantee of Isolation from the other. BC Hydro Distribution Operations will prepare the document for

review and signature by the net metering customer. The LOO is required for the safety of the BC Hydro line crews. The LOO provides information to the line crews about the distributed generator when they are working on the local electrical system. If this information was not available, there is the risk that a line crew may come in contact with an energised line. This could happen as a result of the line crew thinking that the line is isolated from the electric system.

All generating facilities will be inspected and approved by the Electrical Inspector at each customer's expense prior to interconnection. For distributed generating facilities over 5 kW, an acceptance test by BC Hydro Field Service P&C staff will also be required once proof of approval of the Electrical Inspector is obtained by BC Hydro.

The customer is responsible for costs associated with its facility. This includes the meter base and any wiring, protection-isolation devices, disconnect switches and any other modifications to the facility that may be required by BC Hydro's technical requirements.

Termination of Service

The customer may voluntarily terminate his net metering service, however, if this occurs the BC Hydro will not allow the customer to take service under RS 1289 for a period of twelve months, unless BC Hydro otherwise consents.

BC Hydro may terminate the customers service under certain situations. To maintain net metering service, the generator must remain on a BC Hydro Rate Schedule. If service under an applicable Rate Schedule is suspended or terminated for any reason, or if the customer ceases to be billed under BC Hydro's regular billing plan, the net metering service will be deemed to have automatically been suspended or terminated at the same time.

Also, if BC Hydro does terminate or suspend service for any reason, and BC Hydro considers it necessary that the customers generating facility to be re-inspected and approved prior to resuming operation, the customer will be required to pay the costs that BC Hydro estimates it will incur for the inspection or approval.

BC Hydro Application Approval Costs

The following table shows a list of BC Hydro activities and costs per net metering customer application. The activities include review and processing of the application, technical approval, and preparation of local operating order and on-site acceptance check. The technical approval costs vary depending on the size of the distributed generator. The on-site inspection test is only required for distributed generators with generating capacity above 5 kW.

Table 2:

BCH Activity	Inverters to 5 kW	Inverters >5 kW to 50 kW	Rotating Machines To 5.5 kW	Rotating Machines >5 kW to 50 kW
1. Process Application - Office of Generator Interconnections	$100	$100	$100	$100
2. Technical Approval - Distribution Planning	$100	$500	$100	$500
3. Operating Order Preparation	$200	$200	$200	$200
4. On-Site Acceptance Checks	$0	$600	$0	$600
Totals	$400	$1400	$400	$1400

Customer Fee

Table 3:

Customer fee	Residential	Commercial
Site inspection for >5kW	$600	$600

The net-metering customer will only be charged the $600 site inspection cost by BC Hydro staff and this charge is only required if the distributed generating facility has a generating capacity of more than 5kW.

Total Program Costs

Besides the customer fee, any remaining costs of the program will be recovered by passing the costs onto all ratepayers. It is expected that these costs are not likely to be significant given the expected take-up of the program.[1]

The following table shows that the aggregate first year cost per net-metering residential customer can range from $861 to $1261. This includes first year fixed cost and variable meter reading and billing cost. The variable cost per residential net-metered customer is approximately $172 per year.

Table 4:

	Cost <5kW	*Cost >5kW*
One-time costs		
1. Process Application	$100	$100
2. Technical Approval	$100	$500
3. Operating order	$200	$200
4. Meter Install	$60	$60
5. Meter Equipment (assume residential)	$229	$229
Sub-Total	$689	$1,089
Annual Cost		
1. Meter Reading	$54	$54
2. Billing (assume 6 bills)	$118	$118
Sub-Total	$172	$172
Total First Year Cost	$861	$1,261

There are currently only about 6 known customers with distributed generation who would qualify for the net-metering tariff. If the net-metering program attracts

[1] The white paper "Net Metering in British Columbia" (May 26, 2003) prepared for BC Hydro by Compass Resource Management indicated that for significant take-up, customers must be willing to pay a substantial price premium because the cost of typical installed technologies are higher than retail rates.

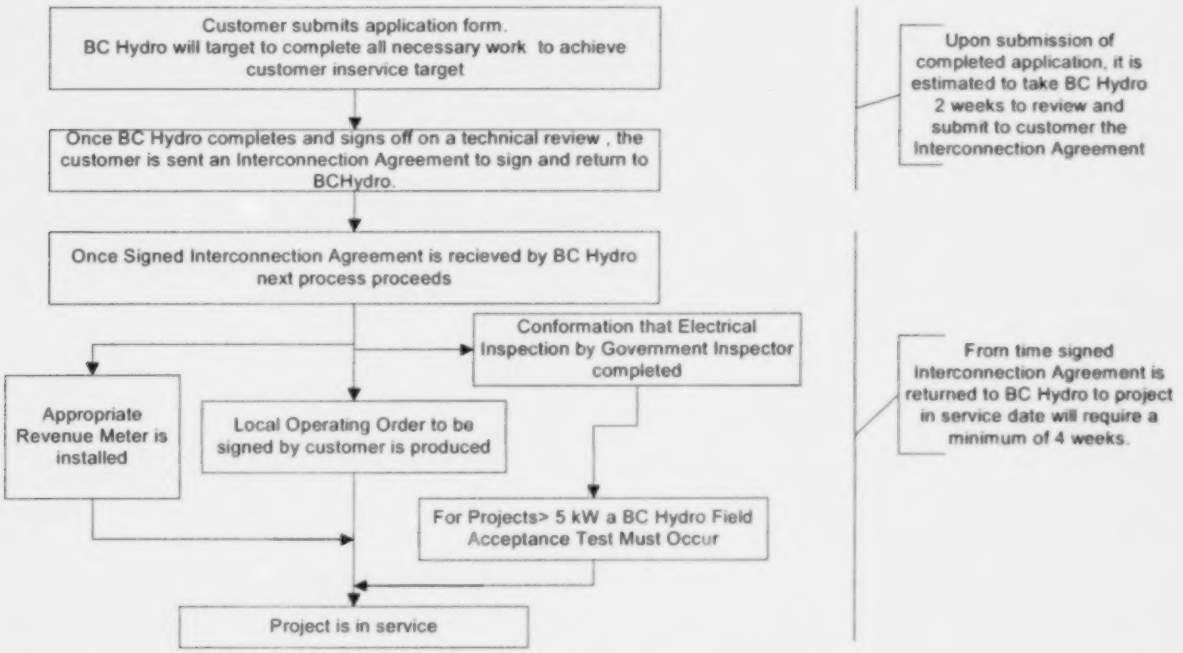
10 subscribers, then the aggregate first year cost will be roughly $10,000 based on these estimates.

Program costs will be reviewed and assessed in the evaluation report of the program.

NET METERING PROCESS

The following flow chart shows the steps that the net-metering customer must complete before its distributed generating facility becomes operational under the net-metering program. Each customer application for net metering will require technical approval, a local operating order, a net meter installed at the site, and electrical inspection. It is estimated that the whole process will take 6 weeks from receipt of net-metering application to the distributed generator being operationally in-service under the program.

Figure 1:


Customer submits application form.
BC Hydro will target to complete all necessary work to achieve customer inservice target
Once BC Hydro completes and signs off on a technical review , the customer is sent an Interconnection Agreement to sign and return to BCHydro.
Once Signed Interconnection Agreement is recieved by BC Hydro next process proceeds
Conformation that Electrical Inspection by Government Inspector completed
Appropriate Revenue Meter is installed
Local Operating Order to be signed by customer is produced
For Projects> 5 kW a BC Hydro Field Acceptance Test Must Occur
Project is in service
Upon submission of completed application, it is estimated to take BC Hydro 2 weeks to review and submit to customer the Interconnection Agreement
From time signed Interconnection Agreement is returned to BC Hydro to project in service date will require a minimum of 4 weeks.

Note: The technical requirements for review of a generator > 5 kW is more detailed and may take longer.

Customers will be required to sign the following documents:

- Net Metering and Interconnection Application - provided by the Office of Generator Interconnections, BC Hydro. (See attachment in Tab F, Appendix 2)
- Net Metering Interconnection Agreement, Electric Tariff Supplement No. 63 (see Tab D)
- Local Operating Order

STAKEHOLDER INPUT

On October 18, 2003, BC Hydro sent stakeholders an e-mail with the following information:

1. Slides summarising the program
2. The draft Net Metering Rate Schedule 1289
3. The draft Net Metering Rate Application
4. The draft Net Metering Interconnection Agreement
5. The draft Net Metering Interconnection Requirements, 50 kW and Below.

The e-mail also provided a BC Hydro contact for questions and concerns and indicated that comments received prior to October 24th, 2003 would be considered for the filing of the application. Tab D provides the comments received.

The list of stakeholders include the following individuals:

1	Steve Baillie		stevebaille@shaw.ca
2	Gary Birch		offthegrid@shaw.ca
3	Mike Cannon	Soltek Powersource	mcannon@spsenergy.com
4	Scott Davis		scottdavis@forebc.com
5	Guy Dauncey		guydauncey@earthfuture.com
6	Michael Doherty	The BC Public Interest Advocacy Centre	mdoherty@bcpiac.com
7	Dermot Foley	David Suzuki Foundation	dfoley@davidsuzuki.org
8	Graydon Givson		norsal@shaw.ca
9	George Isherwood	Aquila Networks Canada (BC) Ltd	george.isherwood@aquila.com
10	Lavern Humphrey	Aquila Networks Canada (BC) Ltd	lavern.humphrey@aquila.com
11	Anita Murray-Hill		anita@mhlconsulting.com
12	Bonnie Mae Newsmall		bon@forebc.com
13	Kevin Pegg		kpegg@energyalternatives.ca
14	Kees Schaddelee		chandrankees@pacificcoast.net
15	Randyn Seibold		biocrew@shaw.ca
16	Patrick Spearing	Solar Thermal	Patrick@SolarThermal.com
17	Michael Wheatley		wheatley@pinc.com
18	Ronan White		ronan@energyoptionsltd.com
19	Paul Willis	Independent Power Association of BC	pwillis@willisenergy.com
20	Eric Smiley	BCIT	esmiley@bcit.ca
21	Kent Webster	Soltek Powersource	kwebster@spsenergy.com
22	D. Engles	Soltek Powersource	degles@spsenergy.com
23	Archie Cardinal		dba-silencing@shaw.ca
24	Richard Wayte	SPS Energy	rwayte@spsenergy.com
25	L. Pitt	University of Victoria	lpitt@uvic.ca
26	Hans van Kessel		hvankessel@ualberta.net

The following features included in the draft tariff sent to the stakeholders have changed in the current proposed tariff:

- Customers on Zone II special contracts were not included as eligible in the draft tariff, but are included in the current proposed tariff.
- Customers with distributed generation using gas-fired cogeneration of heat and power are not eligible to participate in the net-metering program under the current proposed tariff. The BC government's energy plan considers resource categories to be clean energy projects if they result in a net environmental improvement relative to existing BC Hydro energy production. However, it is not clear whether gas-fired cogeneration would be considered clean energy under this definition. Gas-fired generation was also excluded in

BC Hydro's recent green energy call for tender. Therefore, it was decided to exclude gas-fired cogeneration from eligibility under the proposed net-metering tariff.

- Under payment for unused credit in the Generation Account, the $250 threshold above which the customer is paid by cheque has been changed in the current proposed tariff. Instead, a cheque will be written if it is expected that it will take more than 6 months of excess energy to credit back the customer the amount owed.

EVALUATION PROCESS

BC Hydro will keep track of the incremental costs incurred by the net metering program. It will also monitor participation in the program, as well as the excess generation provided by the distributed generators.

BC Hydro proposes to submit an evaluation report to the Commission after one year when there are ten or more customers on the rate.

SUMMARY

BC Hydro's net metering tariff application has been prepared in response to the recommendations made by various stakeholders and the Commission. The form of the tariff meets the parameters provided by the Commission. It is also similar to net metering tariffs that are now widely offered in many other jurisdictions.

Given that take-up of the rate is likely to be limited, BC Hydro believes that the risk of cost shifting to non-participants is low. Experience with the rate will allow BC Hydro to evaluate the program, and propose adjustments to the program features in the future if necessary.

BC Hydro requests that RS 1289 be effective as of the date of the Commission Order.

Tab B

PROPOSED NET METERING TARIFF
RATE SCHEDULE 1289

SCHEDULE 1289

NET METERING SERVICE

Availability: For customers taking service under any of Rate Schedules 1101, 1107, 1200, 1201, 1210, 1211, 1220, 1234, 1255, 1256, 1265 or 1266 and who install a Generating Facility to generate electricity to serve all or part of their electricity requirements, subject to the Special Conditions below.

With the consent of B.C. Hydro, customers taking service under other Rate Schedules or customers in Rate Zone II taking service under special contract, may be admitted to service under this Rate Schedule, provided that B.C. Hydro is satisfied that the metering, billing and other requirements of this Rate Schedule can be met.

"Generating Facility" for purposes of this Rate Schedule means a generating facility that:

(a) Utilizes water, wind, solar, fuel cell, geothermal, biomass, or other inherently self-renewing energy source to generate electricity;
(b) Has a nameplate rating of not more than fifty (50) kilowatts; and
(c) Is owned by the customer and is located on the same parcel of land as the customer's premises for which service is being provided under any of the Rate Schedules listed above, or on an adjacent parcel of land owned or leased by the customer, and is connected to the same Point of Delivery as the customer's premises being served under any of the Rate Schedules listed above;

and includes all wiring, protection-isolation devices, disconnect switches, and other equipment and facilities on the customer's side of the Point of Delivery.

Applicable in: All Rate Zones

Rate:

Energy Charge: Charges for Net Energy consumed by the customer will be in accordance with the Rate Schedule under which the customer is receiving service from B.C. Hydro.

Energy Price: For all electricity represented by the Generation Credit Balance remaining in the customer's Generation Account at any Anniversary Date, B.C. Hydro shall pay 5.4¢ per kW.h.

Metering:

1. Inflows of electricity from the B.C. Hydro system to the customer, and outflows of electricity from the customer's Generating Facility to the B.C. Hydro system, will normally be determined by means of a single meter capable of measuring flows of electricity in both directions.

2. Alternatively, if B.C. Hydro determines that flows of electricity in both directions cannot be reliably determined by a single meter, or that dual metering will be more cost-effective, B.C. Hydro may require that separate meters be installed to measure inflows and outflows of electricity.

3. The customer shall install, at its cost, the meter base and any wiring, protection-isolation devices, disconnect switches, and other equipment and facilities on the customer's side of the Point of Delivery as required under B.C. Hydro's "Net Metering Interconnection Requirements, 50 kW and Below". B.C. Hydro will supply and install the meter or meters and make the final connections.

4. Any meters or meters required for purposes of this Rate Schedule shall be in addition to any demand meters (if applicable) required under the Rate Schedule under which the customer is receiving service from B.C. Hydro.

Billing:

Determination of a Customer's Bill

1. Meter reading and billing frequency will be in accordance with the Rate Schedule under which the customer is receiving service from B.C. Hydro.

2. At the end of each billing period B.C. Hydro will determine the "Net Energy" applicable for that billing period, defined as the difference between the electricity supplied by B.C. Hydro to the customer during the billing period and the electricity delivered from the Generating Facility to B.C. Hydro's system during the billing period.

3. If Net Energy is positive, B.C. Hydro will bill the customer for the Net Energy consumed by the customer during the billing period, subject to the application of any generation credits then in the customer's Generation Account, as described in item 5 below.

4. If Net Energy is negative, B.C. Hydro will credit the Net Energy amount to the customer's Generation Account, as described in item 5 below, and will bill the customer only for the Basic Charge and Demand Charge (if applicable) under the Rate Schedule under which the customer is receiving service from B.C. Hydro.

5. Beginning with the first billing period following the date a customer commences taking service under this Rate Schedule, B.C. Hydro will establish a Generation Account for that customer. If Net Energy is negative for that billing period, B.C. Hydro will credit the Net Energy amount to the customer's Generation Account. B.C. Hydro will likewise follow this procedure for successive billing periods, except that if for any billing period Net Energy is positive, any credit balance then in the customer's Generation Account will be applied to the positive Net Energy amount for that billing period until the Net Energy amount is reduced to zero.

6. B.C. Hydro will follow this procedure, and will notify the customer of amounts credited and debited to the Generation Account and of the remaining credit balance (if any) in the Generation Account, on the bill rendered by B.C. Hydro for each billing period, until the end of the sixth billing period, in the case of customers being billed bi-monthly, or until the end of the twelfth billing period, in the case of customers being billed monthly (the "Anniversary Date"). At the Anniversary Date, B.C. Hydro will credit any negative Net Energy amount for that billing period to the Generation Account, or apply any credits in the Generation Account to any positive Net Energy amount for that billing period, in the same manner as for prior billing periods.

7. If any credit balance ("Generation Account Balance") remains in the Generation Account following the procedures set forth in item 6, B.C. Hydro shall be deemed to have purchased that amount of electricity from the Customer, and shall be obliged to pay the customer for that

electricity at the Energy Price determined in accordance with the Rate provision of this Rate Schedule, and the Generation Account shall revert to zero.

8. The procedures set forth above shall apply in each succeeding 12 month period and at each succeeding Anniversary Date for so long as the customer continues to take service under this Rate Schedule. If service under this Rate Schedule is terminated prior to any Anniversary Date, the procedures set forth above shall be applied as of the date of termination. In that event, B.C. Hydro will pay the amount owing in respect of any credit balance in the Generation Account to the customer within 45 days of the date of termination, subject to any rights of deduction or set-off B.C. Hydro may have.

9. In no case will any credit balance in the Generation Account have any cash value or be convertible to cash, except as provided above. If the amount determined to be owing to the Customer at any Anniversary Date as set forth in item 7 above is equal to or less than the charges B.C. Hydro anticipates are likely to be billed to the customer during the six month period following the Anniversary Date, B.C. Hydro may withhold the amount owing and credit it against charges owing by the customer for future billing periods. If the amount determined to be owing is greater than the charges B.C. Hydro anticipates are likely to be billed to the customer during the six month period following the Anniversary Date, B.C. Hydro shall pay the amount owing to the customer within 45 days of the Anniversary Date.

Special conditions:

1. To receive service under this Rate Schedule the customer must submit the required Application and (if applicable) fee, and enter into a "Net Metering Interconnection Agreement" with B.C. Hydro. The customer must not commence parallel operation of its Generating Facility until approval has been given by B.C. Hydro in accordance with the Net Metering Interconnection Agreement.

2. The Generating Facility and all wiring, equipment and devices forming part of it, shall conform to B.C. Hydro's Net Metering Interconnection Requirements, 50 kW and Below, and shall be installed, maintained and operated in accordance with those Requirements.

3. Service under this Rate Schedule is conditional on the continuance of service to the customer under one or more of the Rate Schedules listed under the Availability section above, and is further conditional on the customer being billed monthly or bi-monthly under B.C. Hydro's

regular billing plan. If service under the applicable Rate Schedule is suspended or terminated for any reason, or if the customer ceases to be billed under B.C. Hydro's regular billing plan, service under this Rate Schedule will be deemed to have automatically been suspended or terminated concurrent with suspension or termination of service under the applicable Rate Schedule, or change to a different billing plan, as applicable.

4. If service under this Rate Schedule is suspended or terminated for any reason, and B.C. Hydro considers it necessary in its discretion for the customer's Generating Facility to be re-inspected and approved prior to resuming parallel operation with B.C. Hydro's system, as provided in B.C. Hydro's Net Metering Interconnection Agreement, the customer shall pay the costs that B.C. Hydro estimates that it will incur for the re-inspection and approval.

5. If the customer voluntarily terminates service under this Rate Schedule, the customer shall not be eligible to again take service under this Rate Schedule for a period of 12 months from the date of termination, unless B.C. Hydro otherwise consents.

6. If B.C. Hydro in its discretion deems it necessary to require the customer to interrupt or disconnect its Generating Facility from B.C. Hydro's system, or for B.C. Hydro to itself effect the interruption or disconnection of the Generating Facility from its system, as provided in the Net Metering Interconnection Agreement, or as a result of suspension or termination of service to the customer in accordance with Special Condition 3 above, then except to the extent caused by the wilful misconduct or gross negligence of B.C. Hydro, its servants or agents, B.C. Hydro and its servants or agents shall not be liable to the customer for any loss or damage whatsoever resulting from such interruption or disconnection.

Tab C

REVISION TO BC HYDRO ELECTRIC TARIFF INDEX

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Tab D

NET METERING PROGRAM AGREEMENT, ELECTRIC SUPPLEMENT NO. 63

NET METERING INTERCONNECTION AGREEMENT

BETWEEN:

(the "Customer")

AND:

BRITISH COLUMBIA HYDRO & POWER AUTHORITY, a body corporate having its head office at 333 Dunsmuir Street, Vancouver, British Columbia

("B.C. Hydro")

Customer and BC Hydro agree as follows:

1. **Applicability**

This Agreement is applicable only to customers who qualify for Net Metering Service under BC Hydro's Rate Schedule 1289 ("RS 1289"), and whose generating facility ("Generating Facility") meets the eligibility requirements set forth in RS 1289. Customer warrants that it and its Generating Facility comply with these requirements.

2. **Generating Facility Interconnection Requirements**

2.1 Customer shall design, install, operate and maintain the Generating Facility, and all ancillary facilities on the Customer's side of the Point of Delivery in accordance with all governmental laws and regulations from time to time applicable, and BC Hydro's *Net Metering Interconnection Requirements, 50 KW & Below* ("NMIR/50"). Customer shall obtain and maintain any required governmental authorizations and/or permits required for the installation and operation of the Generating Facility.

2.2 The Generating Facility shall meet all applicable safety and performance standards, including the codes and standards identified in BC Hydro's NMIR/50. BC Hydro, acting reasonably, may from time to time prescribe additional requirements which in its judgment are required for the safety of its system.

2.3 Customer shall not commence parallel operation of the Generating Facility until written approval has been provided to it by BC Hydro. Written approval will normally be provided

by BC Hydro within 14 days following BC Hydro's receipt of a copy of the final inspection report or approval issued by the governmental authority having jurisdiction to inspect and approve the installation. Where Customer has been notified that inspection and acceptance by BC Hydro's Field Services - Protection & Control Department will also be required before the Generating Facility will be accepted for parallel operation, BC Hydro's approval will normally be provided within 14 days following the date of inspection and acceptance.

2.4 BC Hydro may require Customer to supply additional information and/or provide access to Customer's Generating Facility to carry out additional inspections, as set forth in BC Hydro's NMIR/50.

3. **Operating Requirements**

3.1 Customer shall at all times operate the Generating Facility in accordance with applicable governmental standards and requirements, and any manufacturer's instructions, and shall further comply with BC Hydro standards and requirements from time to time in effect relating to parallel operation of independent net-metering installations with its system. Customer shall promptly notify BC Hydro of any malfunction or breakdown of the Generating Facility that could constitute a safety hazard or reasonably be expected to cause disturbance or damage to BC Hydro's system.

3.2 Customer shall not operate the Generation Facility so as to generate electricity at a rate greater than 110% of the Nameplate Rating of the Generating Facility, and will not add to or modify the Generating Facility without the prior written consent of BC Hydro.

4. **BC Hydro Obligations**

4.1 BC Hydro will act with reasonable promptness to perform any inspections and/or give any approvals that it is authorized or required to give under this Agreement, and will not unreasonably withhold or delay the giving of its consent in any case where its consent is required.

4.2 Subject to the provisions of RS 1289 and any applicable Rate Schedule(s) under which Customer is from time to time receiving electric service from BC Hydro, the provisions of BC Hydro's Electric Tariff, and the terms and conditions of this Agreement, BC Hydro will supply electricity to, and accept delivery of electricity from, Customer at the Point of Delivery.

5. **BC Hydro Rights**

5.1 BC Hydro shall have the right to require Customer to interrupt (including, if so specified by BC Hydro, by means of physical disconnection or lock-out,) or reduce the output of its Generating Facility whenever:

(i) BC Hydro deems such action necessary, in its sole judgment, to permit B.C. Hydro to construct, install, maintain, repair, replace, remove, investigate, or inspect any of its equipment or any part of its electric system; or

(ii) BC Hydro determines in its sole judgment, that curtailment, interruption, or reduction of Customer's electrical generation is otherwise necessary due to emergencies, forced outages, force majeure, safety hazards, possible damage to or disturbance of its electric system, or compliance with prudent electrical practices.

5.2 Notwithstanding section 5.1 or any other provision of this Agreement, in any of the events or circumstances mentioned in section 5.1 BC Hydro shall have the right: (i) to require Customer to immediately disconnect the Generating Facility from BC Hydro's system, and (ii) to itself immediately effect the disconnection of the Generating Facility from its system if Customer is apparently not then available, or is available but refuses to act, and such action is deemed necessary by BC Hydro.

5.3 Whenever feasible BC Hydro will give Customer reasonable advance notice that interruption or reduction in deliveries may be required, or that disconnection of the Generating Facility from BC Hydro's system may be required, but the failure of BC Hydro to give such notice shall not invalidate any action taken by BC Hydro under sections 5.1 or 5.2.

5.4 If B.C. Hydro in its discretion deems it necessary to require the customer to interrupt or disconnect its Generating Facility from B.C. Hydro's system, or for B.C. Hydro to itself effect the interruption or disconnection of the Generating Facility from its system, as provided in sections 5.1 or 5.2, or such interruption occurs as a result of suspension or termination of service to the customer in accordance the provisions of RS 1289, then except to the extent caused by the wilful misconduct or gross negligence of B.C. Hydro, its servants or agents, B.C. Hydro and its servants or agents shall not be liable to the customer for any loss or damage whatsoever resulting from the exercise of such rights by BC Hydro.

5.5 BC Hydro shall have the right to enter Customer's premises at all reasonable hours, without notice to Customer, to inspect Customer's protective devices and read, inspect and/or test meters, or to effect disconnection of the Generating Facility as provided in section 5.2. Nothing in this Agreement shall limit or otherwise affect any rights of entry to Customer's premises BC Hydro may have under its Electric Tariff or any other agreement with Customer.

6. **Metering and Billing**

Metering requirements and billing procedures shall be in accordance with RS 1289, and any other rate schedules under which Customer is receiving electric service.

7. **Term and Termination**

This agreement shall become effective when signed by Customer and BC Hydro, and shall remain in effect indefinitely thereafter, until terminated as follows:

7.1 Customer shall have the right to terminate this Agreement by giving 30 days prior written notice of termination to BC Hydro.

7.2 BC Hydro shall have the right to terminate this Agreement by giving 10 days written notice of termination to Customer if Customer is in material default of any of its obligations under this Agreement and such default if not cured within 30 days after written notice of the default has been given to Customer by BC Hydro. The foregoing shall not affect any rights of suspension, interruption or disconnection that BC Hydro may have elsewhere under this Agreement, RS 1289, or its Electric Tariff.

7.3 This Agreement will terminate automatically concurrent with termination of electric service to Customer under any of the Rate Schedules identified under the "Availability" section of RS 1289.

IN WITNESS WHEREOF the Parties have executed this Agreement.

[Customer Name]

By: _____

Name: _____

Title: _____

Date: _____

BRITISH COLUMBIA HYDRO & POWER AUTHORITY

By: _____

Name: _____

Title: _____

Date: _____

Tab E

STAKEHOLDER INPUT

On October 18, 2003, BC Hydro sent stakeholders an e-mail with the following information:

1. Slides summarising the program
2. A draft of the Net Metering Rate Schedule 1289
3. A draft of the Net Metering Rate Application
4. A draft of the Net Metering Interconnection Agreement
5. A draft of the Net Metering Interconnection Requirements, 50 kW and Below.

The e-mail also provided a BC Hydro contact for questions and concerns and indicated that comments received prior to October 24th, 2003 would be considered for the filing of the application.

BC Hydro received two responses from the stakeholders, which are reproduced below, both of which were favourable to the application. BC Hydro has responded to the queries from the individuals and the response to Mr. Smiley is also included below.

BC Hydro contacted Mr. Willis and discussed his concerns. Regarding the non-eligibility of gas-fired cogeneration projects for RS 1289, BC Hydro explained that the definition of "clean-energy "as contemplated by the Energy Policy is not clear, and that BC Hydro was leaning closer to a "green energy" definition for allowable projects. Green Energy and what the Energy Policy describes as Renewable Resources are comparable. This is also reflected in the price that will be paid for net energy produced at the anniversary date of the generator, which is based on the price paid to the successful bidders in BC Hydro's recent green call.

In response to Mr. Willis' second concern, BC Hydro also revised the Application to make it clear that customers on the rate schedules identified are eligible, whether or not they would be classed as commercial or small industrial.

The following includes comments that have been received from stakeholders and BC Hydro's responses to questions as of October 24th:

1. Received from Eric Smiley, BCIT:

-----Original Message-----
From: Eric Smiley [mailto:Eric_Smiley@bcit.ca]
Sent: Wednesday, October 22, 2003 1:53 PM
To: Folkestad, Craig
Subject: Re: Net Metering Tariff for < 50kW Generation

Craig,

Thank you for sending the proposed submission for my review. I am very
pleased that BC Hydro is taking such as fair and reasonable approach to
interconnection of renewable energy systems and distributed generation.

I only have two comments/questions:

- Is the customer responsible for the cost of a new meter if BC Hydro
determines that a different type of meter is required for reverse
registering?

- Presently, I have been told a Local Operating Order is not required if
the inverter in a photovoltaic system is listed to CSA 22.2 107.1-01.
Why is there now a requirement for a LOO?

Thanks for the opportunity to provide feedback. This is a positive step
forward for renewable energy in British Columbia.

Eric Smiley, BEng, MASc
Project Leader
Photovoltaic Energy Applied Research, Technology Centre
British Columbia Institute of Technology

NE25 - 3700 Willingdon Avenue
Burnaby, British Columbia
Canada V5G 3H2

phone: 604.432.8657 fax: 604.436.0286
esmiley@bcit.ca www.tc.bcit.ca

The following is BC Hydro's response to the questions from Eric Smiley:

From: Folkestad, Craig
Sent: 2003, October 24 7:10 AM
To: 'Eric Smiley'
Subject: RE: Net Metering Tariff for < 50kW Generation

Eric, thanks for your positive comments.

The response to your two questions are:
1. If the meter must be swapped, then BC Hydro will pay for all the costs and recover these costs through all rate payers.
2. Richard Fulton who I understand you know provided the following "I am the source for Eric's information below, and this is a future desired state. When I receive testing lab documentation that specific inverter makes/models are certified to Section 15 of CSA Std 107.1-01 (fail-safe anti-islanding), I will petition Distribution Operations to eliminate the requirement for a LOO for these "acceptable" inverters. The Nov 2001 update of CSA Std 107.1 is now 2 years old, yet I do not have a lab Certificate of Compliance for a single inverter. I think the inverter makers have been focusing their product safety certification in the larger markets, like the US, where the inverter safety Std is UL 1741. I have asked Eric to press the inverter makers, especially Xantrex Technology here in Burnaby, to get their inverters certified to CSA 107.1-01."

I hope this is acceptable to you.

Please let me know if you have any other comments or questions.

Regards

Craig Folkestad
BC Hydro Power Smart
Suite 900 - 4555 Kingsway,
Burnaby, BC V5H 4T8
Phone: 604-453-6230
Fax: 604-453-6285
e-Mail: craig.folkestad@bchydro.com

The following is Eric Smiley's response:

From: Eric Smiley [mailto:Eric_Smiley@bcit.ca]
Sent: Friday, October 24, 2003 12:35 PM
To: Folkestad, Craig
Subject: RE: Net Metering Tariff for < 50kW Generation

Thanks for your answers. The proposed tariff is quite reasonable.

I am pushing Xantrex to update their listings and I recently heard from
another manufacturer that they have cUL listing for their inverters to
CSA 107.1-01. I will get them to submit the documentation to Richard
ASAP.

Eric

2. Comments received from Paul Willis (Independent Power Association of BC):

October 24, 2003

Craig Folkestad
BC Hydro
Suite 900 - 4555 Kingsway
Burnaby, BC
V5H 4T8

Dear Craig:

Net Metering Tariff

I support BC Hydro's submission to the British Columbia Utilities Commission with respect to the proposed Net Metering Service Tariff 1289. Generally, the conditions and the rates indicated appear fair and appropriate.

I have not had a chance to review in detail the interconnection conditions specified and the impact that those conditions may have on potential projects. I will do that and will also try to get additional input from others on that subject.

The proposed rate schedule indicated that hydro, wind, solar, fuel cell, geothermal, biomass, and cogeneration of heat and power projects would be eligible. I agree with this list and assume that gas fired cogeneration projects would be accordingly eligible. Some of the other documents supplied, explaining the proposed rate were not as clear on this subject.

The proposed rate schedule also indicated that all customers taking service under any of Rate Schedules 1101, 1107, 1200, 1201, 1210, 1211, 1220,

1255, 1256, 1265 or 1266 would be eligible. I agree with that list. Some of the other documents explaining the rate should perhaps be clearer in explaining these eligibility criteria. When the term "Commercial" is used small industrial customers may assume that they are not eligible.

Thanks for the opportunity to comment at this stage.

Yours truly,

Paul Willis

Tab F

APPENDICES

1

Appendix 1

Summary of US State Metering Programs

State	Eligible Fuel Types	Eligible Customers	Limit on System Size	Limit on Overall Enrollment	Treatment of Net Excess Generation (NEG)[1]	Enacted	Citation / Reference
Arizona	Renewables & cogeneration	All customer classes	≤ 100 kW	None	Monthly NEG purchased at avoided cost	1981	AZ Corp. Comm. Decision No. 52345
Arkansas	Solar, wind, hydro, geothermal & biomass [2]	All customer classes	≤ 25kW (residential); ≤ 100kW (commercial or agricultural)	None	Not specified	2001	HB 2325 (enacted April 2001; effective Oct 2001)
California [3]	Solar and Wind	*All customer classes*	*≤ 1000 kW*	*None*	Customers are billed annually; excess generation is granted to the utility. Allows bi-directional time-of-use metering	1995	CA Public Utilities Code § 2827 (as amended 1998, 2000 & 2001)
Colorado	All resources	All customers	≤ 10 kW	None	NEG carried over month-to-month	1994	Public Service Co. of CO, Advice Letter 1265; Decision C96-901
Connecticut	Solar, wind, hydro, fuel cell, sustainable biomass	Residential only	No limit	None	Not specified	1998	Conn Gen Stat 16-243h
Delaware	Renewables	All customer classes	≤ 25 kW	None	Not specified	1999	DE Legislature, S Amend 1 to HB 10
Georgia	Solar, wind or fuel cells	Residential or commercial	≤ 10 kW residential ≤ 100 kW commercial	0.2% of previous year's annual peak demand for each utility	NEG credited to following month; at end of annual period any unused credits are granted to utility without compensation.	2001	Senate Bill 93
Idaho	Renewables & cogeneration	Idaho Power only; residential and small commercial customers	≤ 100 kW	None	NEG purchased at avoided cost	1980	ID PUC Orders No. 16025 (1980); 26750 (1997)
Illinois	Solar and wind	ComEd only; all customer classes	< 40 kW	0.1% of annual peak demand	NEG purchased at avoided cost	1999	Special billing experiment (effective 4/1/00)
Indiana	Renewables & cogeneration	All customer classes	≤ 1,000 kWh/month	None	Monthly NEG granted to the utility.	1985	170 IN Admin Code § 4-4.1-7
Iowa	Renewables	All customer classes	No limit	None	NEG purchased at avoided cost	1983	IA Legislature & IA Utilities Board, Utilities Division Rules § 15.11(5)
Maine	Renewables, fuel cells & recycled municipal solid waste	All customer classes	≤ 100 kW	None	NEG credited to following month; at end of annual period unused credits granted to utility without compensation	1998	Code Me. R. Ch. § 313 (1998); see also Order No. 98-621 (December 19, 1998).

Maryland	Solar only	Residential customers & schools	≤ 80 kW	0.2% of 1998 peak demand	NEG carried over to following month; otherwise not specified	1997	MD Legislature, Art. 78, Sec. 54M
Massachusetts	Renewables & cogeneration	All customer classes	≤ 60 kW	None	NEG purchased at avoided cost	1997	Mass. Gen. L. ch. 164, § 1G(g); Dept. of Tel. & Energy 97-111
Minnesota	Renewables & cogeneration	All customer classes	< 40 kW	None	NEG purchased at "average retail utility energy rate"	1983	Minn. Stat. § 261B.164(3)
Montana	Solar, wind or hydro	All customer classes	≤ 50 kW	None	NEG credited to following month; unused credit is granted to utility at end of 12-month period	1999	S.B. 409
Nevada	Solar and wind	All customer classes	≤ 10 kW	100 customers for each utility	Annualization allowed; no compensation required for NEG	1997	Nev. Rev. S. Ch. 704
New Hampshire	Solar, wind & hydro	All customer classes	≤ 25 kW	0.05% of annual peak	NEG carried over to following month	1998	NH Rev. Stat. §§362A:1-a & 362-A:9
New Jersey	Photovoltaic and wind	Residential and small commercial customers	No limit (100 kW limit proposed)	0.1% of peak **or** $2,000,000 annual financial impact	NEG credited to following month; unused credit is purchased at avoided cost.	1999	NJ Rev Stat §48:3-87 Sec. 38(e)
New Mexico	Renewables & cogeneration	All customer classes	≤ 10 kW	None	At utility's option, customer is credited on the next bill for (1) purchase of NEG at utility's avoided cost; or (2) kilowatt-hour credit for NEG that carries over from month to month.	1999	NM PRC Order 2847 (9/7/99), amending previous Order from 11/30/98
New York	Solar only	Residential only	≤ 10 kW	0.1% of 1996 peak	NEG credited to following month; unused credit is purchased at avoided cost	1997	NY Public Service Law § 66-j
North Dakota	Renewables & cogeneration	All customer classes	≤ 100 kW	None	NEG purchased at avoided cost	1991	ND Admin. Code § 69-09-07-09
Ohio	Solar, wind, biomass, landfill gas, hydro, microturbines, or fuel cells	All customer classes	No limit	1.0% of peak demand for each retail electric provider	NEG purchased at unbundled generation rate, appears as credit on following bill	1999	S.B. 3 (effective 10/6/99)
Oklahoma	Renewables & cogeneration	All customer classes	≤ 100 kW and annual output ≤ 25,000 kWh	None	Monthly NEG is granted to the utility.	1990	OK Corp. Comm. Schedule QF-2
Oregon	Solar, wind, fuel cell and hydro	All customer classes	≤ 25 kW	No less than 0.5% of utility's historic single-hour peak load; beyond 0.5% eligibility can be limited by regulatory	NEG purchased at avoided cost or credited to following month; at end of annual period unused credits shall be granted to low-income assistance programs, credited to customer, or "dedicated to other use" as determined by regulatory authority	1999	Ore Rev Stat 757.300

				authority			
Pennsylvania	Renewables only (includes fuel cells)	All customer classes	≤ 10 kW	None	NEG granted to utility at end of month	1998	PA PUC, Miscellaneous Individual Utility Tariffs
Rhode Island	Renewables & fuel cells	All customer classes	≤ 25 kW	1 MW for Narragansett Electric	NEG credited to following month; unused credit is granted to utility at end of annual period	1998	RI PUC, Order, Docket No. 2710
Texas	Renewables only	All customer classes	≤ 50 kW	None	NEG purchased at avoided cost	1986	PUC of Texas, Substantive Rules, § 23.66(f)(4)
Vermont	Solar, wind, fuel cells using renewable fuel, anaerobic digestion	Residential, commercial, and agricultural customers	≤ 15 kW, except ≤ 100 kW for anaerobic digesters (4)	1% of 1996 peak	NEG credited to following month; at end of annual period any unused credits are granted to utility without compensation	1998	VT Stat Ann §219a (as amended 1999)
Virginia	Solar, wind and hydro	Residential and commercial	≤ 10 kW (residential) ;≤ ≤ 25 kW (commercial)	0.1% of annual peak demand	NEG is credited to following month; at end of annual period, excess generation is carried over to the next annual period.	1999	Va. Code Ann §56-594
Washington	Solar, wind and hydropower	All customer classes	≤ 25 kW	0.1% of 1996 peak	NEG credited to following month; unused credit is granted to utility at end of annual period	1998	WA Legislature, House Bill 2773
Wisconsin	All Resource	All retail customers	≤ 20 kW	None	NEG purchased at retail rate for renewables, avoided cost for non-renewables	1993	WI PSC, Schedule PG-4
Wyoming	Solar, wind and hydropower	All customer classes	≤ 25 kW	None	NEG credited to following month; at end of annual period any unused credits are purchased by utility at avoided cost	2001	WY Legislature, House Bill 195, signed February 2001, effective July 2001.

(1) In all cases, energy generation is netted against energy consumption on an equal basis, down to zero net energy use during the designated period. Treatment of 'net excess generation' is relevant only when total generation exceeds total consumption over the ewntire billing period, i.e., the customer has more than offset his/her total electricity use and has a negative meter reading.

(2) The Arkansas law also extends eligibility to fuel cells or microturbines if the fuel is derived entirely from renewable resources.

(3) The 2001 amendments, which (A) extended eligibility to all customer classes; (B) extended the system size limit to 1,000kW (1MW), and (C) eliminated the overall "cap" of 0.1% of each utility's peak demand applies through the end of 2002 only. Absent further amendment these provisions would revert to pre-2001 requirements.

(4) The Vermont law was amended in 1999 to allow Vermont Public Services Board to permit net metering for up to five systems per year that produce more than 15 kilowatts (AC) capacity, but do not produce more than 100 kilowatts of power and do not use methane gas.

Source: American Wind Energy Association, 2001.

2

Appendix 2

BC hydro

THE POWER IS YOURS

Net Metering Interconnection Application

Applicant Identification						
Surname				Street Address		
Given Name				City		
Phone				Province		
Fax				Country		
Email				Postal Code		
Signature				Date		
Contractor or Installer Information						
Company Name						
Surname				Street Address		
Given Name				City		
Phone				Province		
Fax				Country		
Email				Postal Code		
Power Generator Information						
Rated Capacity (kW)						
Energy Resource	Wind	Solar	Hydro	Biomass	Other (specify)	
Manufacturer						
Model						
Output Voltage (V)						
Targeted In-Service Date						
Inverter Information (where applicable)						
Rated Capacity (kW)						
Manufacturer						
Model						
Output Voltage (V)						
Storage battery in the system?				Yes	No	
Single line electrical diagram enclosed?				Yes	No	
BC Hydro						
Received by				Date		

When completed, attach an "electric single-line diagram" to this application and send to:

Office of Generator Interconnections
6911 Southpoint Drive, E10
Burnaby, BC V3N 4X8
Phone: (604) 528-3313
FAX: (604) 528-3392
E-mail: gen.connections@bchydro.com

To get more information, see http://www.bchydro.com/info/ipp/ipp992.html.

BC hydro

THE POWER IS YOURS

Information for Net Metering Application

ELEGIBILITY

The net metering application is for the interconnection of a solar, wind, biomass or hydro generating facility with a rated capacity up to 50 kW that is located on the premises of a residential or small commercial customer on the following rates:

1101, 1107, and
1200, 1201, 1210, 1211, 1220, 1234, 1255, 1256, 1265, 1266

Zone II customers taking service under Tariff supplement Special contracts are also eligible provided that BC Hydro is satisfied that the metering, billing and other requirements of the net-metering tariff can be met.

The generator operates in parallel with BC Hydro's electric system, and offsets a part or all of customer's own electrical power requirements.

USE OF THE APPLICATION FORM

This document is solely an application for a contract. It does not authorize you to interconnect your generating facility with BC Hydro's electric system. You and BC Hydro must first sign an interconnection agreement and comply with the terms of such an agreement. You must not interconnect your generating facility until BC Hydro provides you with a letter specifically stating that all of the interconnection requirements have been satisfied and authorizes the interconnection.

REQUIRED INFORMATION

Please submit a completed application and an "electric single-line-diagram" of the system to be installed showing the arrangement of the components from generator to your service entrance main switch. It may be necessary for BC Hydro to request additional information from you or your contractor to clarify the details of your installation.

CONTACT

Office of Generator Interconnections
6911 Southpoint Drive, E10
Burnaby, BC V3N 4X8
Phone: (604) 528-3313
FAX: (604) 528-3392
E-mail: gen.connections@bchydro.com

To get more information, see http://www.bchydro.com/info/ipp/ipp992.html.

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Appendix 3

NET METERING INTERCONNECTION REQUIREMENTS, 50 KW & BELOW

RATE SCHEDULE RS 1289

22 October 2003

BC hydro

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1.0 INTRODUCTION

This document guides generator owners in connecting generators to the BC Hydro (BCH) distribution system where the BCH service voltage is 600 V or less. The generator may export electricity periodically across the BCH revenue meter into the BCH distribution system.

This document applies to dc-ac inverter-based systems and rotating machines (induction or synchronous generators) for plant ratings up to 50 kW. An induction generator is an induction motor driven as a generator. The net metering customer is referred to as a Distributed Generator (DG).

This document describes BCH connection requirements, the minimum design standards the DG System must satisfy, and the range of normal and emergency system conditions the DG System may encounter while connected to the BCH distribution system. When information on the location, size and type of the DG development is received, BCH will provide the DG technical interconnection requirements.

The information contained in this document is subject to future revisions.

The intent of this document is to assist BCH in attaining the common goal that the design, construction and operation of the DG will:

(a) be compatible with and safe at all times for the BCH equipment and system, for BCH employees or agents, for BCH customers and the general public,
(b) maintain a high standard of power quality for electricity generated,
(c) meet revenue metering requirements,
(d) facilitate timely and efficient handling by BCH of information provided by the proponent relevant to design, construction and operation of the DG.

Important notes of limitations include:

(a) this document is not intended or provided by BCH as a design specification or as an instruction manual for the DG owner, employees or agents and the document shall not be used by the proponent, his employees or agents for those purposes. Persons using this information do so at no risk to BCH and they rely solely upon themselves to insure that their use of all or part of this document is appropriate in the particular circumstance,

(b) the DG owner, employees or agents recognize that they are, at all times, solely responsible for the generator plant design, construction or operation. BCH, its employees or agents shall not be or become the agent of the proponent in any manner howsoever arising,
(c) the advice by BCH, its employees or agents, that the generating plant design or equipment meets certain BCH requirements does not mean, expressly or by implication, that all or any of the requirements of the law or good Engineering practices have been met by the owner and such judgement shall not be construed by the owner or others as an endorsement of the design or as a warranty by BCH, its employees and agents, of the design or equipment, or any part thereof.

2.0 DEFINITIONS AND REFERENCES

2.1 Acronyms and Definitions

2.1.1 Acronyms

BCH: BC Hydro

CSA: Canadian Standards Association, an accredited standards development organisation within Canada.

IEEE: The Institute of Electrical and Electronics Engineers, Inc., an organisation that develops voluntary standards relating to electrical safety and product performance.

UL: Underwriters Laboratory, an accredited standards development organisation within the United States of America.

2.1.2 Definitions

Alternating Current (ac): Electric current that periodically alternates direction of flow and is zero at some time during its period.

Direct Current (dc): Electric current that flows in one direction.

Distributed Generation (DG): Electric power generation facilities connected to the BCH Distribution System through the Point of Delivery & Receipt (PODR).

Distribution System: That part of the BC Hydro system that operates at 34,500 V or less and distributes electric power between BC Hydro substations and PODRs.

Hertz (Hz): The common unit used to describe periodic event frequency. It is a measure of the number of times or cycles that a periodic signal repeats in a second, also denoted as *cycles per second.*

Interconnection: The result of the process of electrically connecting a DG System in parallel with the BCH Distribution System.

Inverter: A power electronic device, which converts dc power into ac power.

Island: A condition in which a portion of the BCH Distribution System is energized by one or more DG Systems while that portion of the Distribution System is electrically separated from the rest of the Distribution System.

DG System: The aggregate of the DG electricity generator, inverter(s), control system(s), sensing device(s) or function(s), and protection devices and functions to the customer service entrance disconnect switch.

Parallel Operation: the simultaneous energization of a PODR by the Distribution System and the DG System.

Point of Delivery & Receipt (PODR): The point where the BCH service conductor/cable is connected to the BCH revenue meter(s).

Stabilized: Refers to the Distribution System voltage returning to the normal range of level and frequency for 5 minutes or a time as co-ordinated with BCH, following a disturbance.

Total Harmonic Distortion (THD): A measure of the total sum of squares of harmonic frequency signals compared to a fundamental frequency signal.

Voltage Follower Mode: An inverter operation mode that follows the waveform of an external source and depends on the external source to initiate and maintain its operation while delivering power to that source.

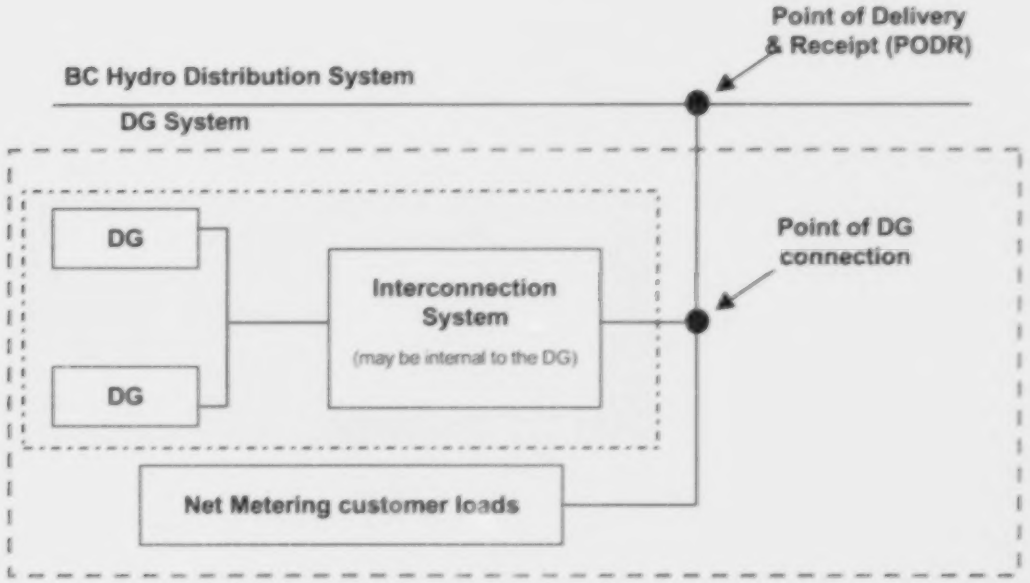


Figure 1: Relationship of DG System and Interconnection Terms

2.2 References

CSA Standard 2002 Canadian Electrical Code Part 1, Nineteenth Edition, C22.1-02, *Safety Standards for Electrical Installations* (CE Code)

CSA Standard C22.2 No. 107.1-01 *General Use Power Supplies.* Section 15 covers grid-connected inverters.

CSA CAN-3-C235-1995 *Preferred Voltage Levels for AC Systems, 0 to 50,000 Volts,* Canadian Utility Distribution systems.

IEEE 519 – 1992 *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.*

3.0 GENERAL INTERCONNECTION AND PROTECTION REQUIREMENTS

Refer to Definitions section 2.1.2 for a diagram showing the DG System and interconnection to BCH.

Section 3.1 lists the typical BCH Distribution System operating and power quality conditions within which the DG System operates. It lists representative values of parameters that BCH attempts to maintain and some abnormal conditions that the DG equipment needs to be designed to withstand.

Section 3.2 lists typical conditions and response to abnormal conditions that the DG System shall meet.

3.1 BC HYDRO DISTRIBUTION SYSTEM OPERATING CONDITIONS

It is the DG owner's responsibility to ensure that the DG System operates correctly in this environment.

3.1.1 System Frequency

The Distribution System operates at 60 Hz. Frequency deviations are typically 59.7 Hz to 60.2 Hz for small contingencies that cause modest disturbances, i.e. where the DG System continues connected to the Distribution System. For large contingencies, broader frequency variations can occur. These variations can be experienced under severe Distribution System loads, load variations, or when major generation or transmission is lost, or BCH load shedding schemes are employed.

3.1.2 System Voltage

CSA Standard CAN3 C235-95, ***Preferred Voltage Levels for AC Systems 0 to 50,000 V,*** provides recommended Canadian utility Distribution System steady-state service voltage levels. DG Systems must operate satisfactorily within the extreme voltage level variation limits shown in Table 1 and may continue to operate beyond these limits (per 3.2.7) to allow the utility automatic voltage regulation equipment time to function. Voltage regulation is a utility responsibility and voltage regulation schemes should not be employed by DG Systems except under agreement with BCH.

Table 1: Recommended Steady-State Service Voltage Variation Limits for Canadian Utilities

Nominal System Voltages	Recommended Voltage Variation Limits for Circuits Up to 1000 volts, Applicable at Service Entrance			
	Extreme Operating Conditions			
		Normal Operating Conditions		
Single Phase				
120/240	106/212	110/220	125/250	127/254
240	212	220	250	254
480	424	440	500	508
600	530	550	625	635
Three Phase 4-Conductor				
120/208Y	110/190	112/194	125/216	127/220
240/416Y	220/380	224/388	250/432	254/440
277/480Y	245/424	254/440	288/500	293/508
347/600Y	306/530	318/550	360/625	367/635
Three Phase 3- Conductor				
240	212	220	250	254
480	424	440	500	508
600	530	550	625	635

Source: Preferred Voltage Levels for AC Systems, 0 to 50 000V- Canadian Standards Association

3.1.3 Harmonic Distortion

IEEE Standard 519-1992, ***Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems***, sets the quality of power that the utility is to deliver to the customer PODR, and describes the voltage and current waveforms that exist throughout the Distribution System. Transient conditions exceeding the limits may be encountered. Remote sections of rural Distribution System may exceed the limits. IEEE 519 Section 11.5 recommends that the voltage harmonic distortion limits as a percentage of the nominal fundamental frequency voltage in the utility

service should not exceed 3% for any individual harmonic, and 5% for the total voltage harmonic distortion.

3.1.4 Voltage Unbalance

The voltage unbalance on the Distribution System under normal operating conditions is typically under 3% but may reach 5% due to the unbalanced loading and single-phase voltage regulation. Voltage unbalance is included in the BCH service voltage range of Table 1 in section 3.1.2.

Voltage unbalance is calculated using RMS voltage levels measured phase to phase at the service entrance under no load conditions:

Voltage unbalance (%) = 100 x [(max. deviation from average) / (average)]

3.1.5 Fault and Line Clearing

BCH may use automatic reclosing to maintain the reliability of the Distribution System. The DG owner needs to be aware of line reclosing when designing DG System protection schemes to ensure that the DG System ceases to energize the Distribution System prior to automatic reclose of BCH substation circuit breakers or line reclosers.

3.2 DG SYSTEM INTERCONNECTION

This section provides the technical requirements to be met by the DG System interconnection with the Distribution System. Typical operating conditions, protection functions, and response to abnormal conditions that the DG System should meet are listed.

3.2.1 Point of Delivery & Receipt – Responsibilities and Quantity Measurement

The Point of Delivery & Receipt (PODR) will be identified on the DG System single line diagram. BCH will co-ordinate design, construction, maintenance and operation of the facilities on the BCH side of the PODR. The DG owner is responsible for the design, construction, maintenance and operation of the facilities on the DG side of the PODR.

In regard to protection functions, the aggregate of DG units rated 30 kW and under may measure voltage level and frequency directly on the ac side of the power generator. Aggregate of DG units larger than 30 kW may measure voltage amplitude and frequency at the customer's service entrance mainswitch, or directly on the ac side of the power generator, as agreed with BCH.

3.2.2 Point of Disconnection - Safety

A disconnecting means to provide a point of isolation between the DG System and the Distribution System is required. Low voltage disconnecting means must meet the intent of the CE Code, Section 84. The purpose of the disconnecting means is to provide safe isolation between the Distribution

System and the DG System for safe work purposes. BCH may require additional warning tags or labels to be placed at the DG site.

BCH Safety Practice Regulations:

(a) the customer installs an accessible, load-break disconnect switch, lockable in the open position with a visible break, near the utility meter. This switch is installed between the inverter's ac output and the customer's service entrance ac circuit breaker. This disconnect switch is also required under Rule 84-026 of the Canadian Electrical Code, Part 1. A low-voltage safety switch, where the cover can be opened when the switch is in the "open" position, thus providing visual verification that the contacts are open, is acceptable,

(b) a Local Operating Order will be prepared by the BCH Area Control Centre, for signature by the DG owner. This document defines such items as the switching authority boundary between BCH and the DG, the procedure for either party to obtain a Guarantee of Isolation from the other party, and personnel contact names and phone numbers for BCH and the DG owner.

3.2.3 Interconnection Grounding

DG Systems must be grounded as per manufacturer's recommendations, the CE Code, and take into account that BCH electric service conductors/cables are grounded.

3.2.4 Interrupting Device Ratings

The design of the DG System must consider the fault current contributions from both BCH and the DG System, to ensure that all circuit fault interrupters are adequately sized. If requested, BCH will inform the DG owner of the present and anticipated future fault current contribution from the BCH Distribution System at the PODR.

3.2.5 Overcurrent Protection

The DG System must detect and promptly cease to energize for overcurrent fault conditions in the DG System.

3.2.6 Under-Voltage and Over-Voltage Protection

Every grid-connected DG System requires under/over voltage protection and under/over frequency protection.

Three-phase inverter DG Systems shall cease to energise when any individual phase-to-neutral voltage on a grounded-wye system or any individual phase-to-phase voltage on a ungrounded-wye or delta system goes outside the range of Table 2. Single-phase inverter DG Systems shall detect the phase-to-neutral voltage if connected to neutral. Single-phase equipment connected line-to-line but not to the neutral conductor shall detect the line-to-line voltage.

DG Systems rated more than 30 kW may be required to meet the alternate limits and trip times shown in Table 2.

The DG System shall not attempt to regulate the voltage and shall not adversely affect voltage at the PODR. BCH will decide if voltage regulation is expected to be a concern and identify solutions during the technical review.

DG Systems using rotating machines (induction or synchronous generators) without inverters submit their proposed under/over voltage protection settings/timing to BCH for approval.

Table 2: Inverter Response to Abnormal Voltage Levels

For DG Systems Rated ≤ 30 kW **Source CSA C22.2 No. 107.1-01 Table 16**		**For DG Systems Rated > 30 kW**	
Voltage Condition	Max. number of cycles to disconnect	Voltage Condition	Max. number of cycles to disconnect
V < 50%	6 cycles	V < 50%	6 cycles
50% < V < 88%	120 cycles	50% ≤ V < 88%	120 cycles
---	---	106% < V < 110%	Field adjustable trip may be required*
110% < V < 137%	120 cycles	110% ≤ V < 120%	120 cycles
		120% ≤ V < 137%	120 cycles (10 cycles may be required)*
137% < V	2 cycles	137% ≤ V	2 cycles

**The CE Code Part 2 Product Standard allows a wider normal voltage range than 3.1.2 to allow line regulation equipment time to function. Field adjustable settings for larger DG Systems may be required to improve protection. Field adjustable settings shall be adjusted by qualified personnel only.*

3.2.7 Under Frequency and Over Frequency Protection

DG inverter Systems shall cease to energize during over and under frequency conditions and at preset delay times per Table 3 and shall not reconnect until the Distribution System has Stabilized. For inverter DG Systems capable of supplying more than 30 kW, at least one adjustable under frequency setting and one over frequency setting with adjustable clearing time is generally advised. Individual DG units rated greater than 30 kW require adjustable settings.

Table 3a: Inverter Frequency Operating Limits for DG ≤ 30 kW

Frequency Operating Limits		Source CSA C22.2 No. 107.1-01 Table 16
Utility Voltage Condition	Frequency	Maximum number of cycles to disconnect
Rated voltage	F < rated – 0.5 Hz*	6
Rated voltage	F > rated + 0.5 Hz	6

*The UL 1741 standard and the new IEEE 1547 use F < rated – 0.7. Update when CSA C22.2 No. 107.1-01 is changed.

Table 3b: Inverter Frequency Operating Limits for DG > 30 kW

Frequency Operating Limits		
DG System capacity.	Frequency Range	Number of cycles to disconnect
> 30 kVA	First 59.8 – 57	6 – 18,000
	F > 60.5 Hz	6 – 10,800

DG Systems using rotating machines (induction or synchronous generators) without inverters submit their proposed under/over frequency protection settings/timing to BCH for approval.

3.2.8 Anti-Islanding

The DG System shall meet the anti-islanding requirements of CSA Standard C22.2 No. 107.1-01, ***General Use Power Supplies***, Section 15, and cease to energize the Distribution System within a time no greater than two seconds after the formation of an unintentional island.

3.2.9 Power Factor

The DG System is not required to be capable of adjusting the power factor but shall operate in the preferred range of ±0.90. If the DG System disturbs the Distribution System voltage levels at the PODR, then the DG may be required to operate the DG System within a smaller range or take other compensatory measures.

3.2.10 Voltage Flicker

The DG System shall not cause objectionable flicker on the Distribution System. It is recognised that flicker is a site dependent condition. Voltage flicker is an increase or decrease in voltage over a short period of time, normally associated with motor starting or fluctuating load. The characteristics of a particular flicker problem depend on the characteristics of the load change.

The limits for voltage flicker caused by the DG System at the PODR are:

Voltage Dip Not to Exceed	Number of Times Permitted
3.3% of normal voltage	up to once per hour in urban systems supplying many customers
6.5% of normal voltage	up to once per hour in rural systems supplying few customers

Voltage dips more frequent than once per hour must be limited to the "Borderline of Irritation" curve of Figure A-3, "B.C. Hydro's Voltage Flicker Limits".

3.2.11 Harmonic Distortion

DG Systems are expected to comply with IEEE Standard 519 current distortion limits, as listed in Table 4, below. For inverters only capable of operating in voltage follower mode, voltage harmonic distortion limits are not specified. Inverters certified to CSA Standard 107.1-01 are considered to meet these requirements. CSA Standard 107.1-01 excludes current harmonics due to voltage distortions in the utility Distribution System. Total current harmonic distortion shall not exceed 5% of rated current.

Table 4: Inverter or Rotating Machine Limit of Current Harmonic Distortion

Limits of Current Harmonic Distortion*		***Source CSA C22.2 No. 107.1-01 Table 15**
Harmonic Numbers	Maximum distortion	
	Even Harmonics	Odd harmonics
2nd through 9th	1.0%	4.0%
10th through 15th	0.5%	2.0%
16th through 21st	0.4%	1.5%
22nd through 33rd	0.2%	0.6%
Above 33rd	0.1%	0.33%

3.2.12 Voltage Unbalance

When single-phase DG units are connected in multiple units, if three-phase service is available, then approximately equal amounts of generation capacity should be applied to each phase of a three-phase circuit.

3.2.13 DC Injection

The DG System shall not inject a dc current greater than 0.5% of the unit rated output current after a period of six cycles following connection to the Distribution System.

3.2.14 Synchronization

DG Systems that can generate an ac voltage waveform independent of the Distribution System shall be connected in parallel with BCH only in combination with synchronizing capabilities. The DG System shall synchronize to the Distribution System while meeting the flicker requirements of 3.2.10 and without causing voltage variation at the PODR of greater than 5%. The DG System may synchronise when the Distribution System is Stabilized.

Induction generators do not require synchronization since there is no generated voltage prior to connecting to BCH. The generator speed is brought to within 0.5% of its rated value then connected. Induction generators may be started as induction motors using power from the BCH system provided that these units do not cause unacceptable voltage flicker on start-up or on connect/disconnect. Induction generators shall be compensated in the DG System to a full load power factor of 0.90 or better.

For synchronous generators, an approved automatic synchronization device must be provided in all cases where the plant is to be operated unattended. If the plant is attended, the generator may be equipped with a manual synchronization device with relay supervision. The operator on site must have sufficient training to perform the function safely. Synchronization controls shall satisfy the following conditions:

(a) the generator speed should be matched to within 0.5% of its rated speed or a frequency difference within +/- 0.5 Hz,

(b) the phase angle difference between the generator and BCH should be less than 15 degrees,

(c) the RMS voltage magnitude difference between the two systems should be less than 4% to avoid excessive currents,

(d) field current should not be applied until the generator speed is at least 85% of its nominal value.

3.3 TYPICAL INTERCONNECTION PROTECTION FUNCTION REQUIREMENTS

The DG System shall meet the applicable protective functions in Table 5.

Table 5: Inverter & Rotating Machine Interconnection Protection Function Requirements[1,2,3]

Function		1 Phase	3 Phase		
			≤ 30 kW	30 kW – 50 kW	
	AC Disconnect Means	Y	Y	Y	
	Anti-Islanding	Y	Y	Y	
25	Automatic Synchronizing[4]	Y	Y	Y	
27	Under-Voltage Trip	Y	Y(3)	A(3)	
59	Over-Voltage Trip	Y	Y(3)	A(3)	
50	Instantaneous Overcurrent[5]	Y	Y(3)	Y(3)	
51	Timed Overcurrent[5]	Y	Y(3)	Y(3)	
81/U	Under-Frequency Trip	Y	Y	A	
81/O	Over-Frequency Trip	Y	Y	Y	
	Secondary Injection Capability				

Notes:

1. Interconnection of 1 and 3 phase generation units connected at 600 volts or less in accordance with Canadian Electrical Code
2. Y = required; A = adjustable set points may be required as per 3.2.6 and 3.2.7.
3. Number of phases monitored shown in parentheses, e.g. (3)
4. Inverters with standalone capability, and synchronous generators.
5. 50/51 functions may be met by fuses or circuit breaker

4.0 INSPECTION, TESTING AND COMMISSIONING

4.1 General

B.C. Hydro's interest in commissioning is to ensure that the DG System does not pose safety hazards, meets the performance criteria of power quality and system reliability during normal and abnormal conditions, and does not adversely affect the operation of the BCH power system. Involvement of BCH personnel in commissioning does not mean, expressly or by implication, that all or any of the requirements of the law or good Engineering practices have been met by the DG System.

BCH may inspect DG System equipment, documents and installation procedures, and witness field tests. The DG owner shall notify BCH at least 2 weeks before the initial energizing and start-up testing of the DG System. Wherever practical, inspection timing and scheduling shall be mutually agreed by the DG owner and BCH.

For DG systems rated > 5 kW, step-by-step energizing and commissioning procedures shall be provided to BCH prior to DG System commissioning. The DG owner shall make available to BCH a complete set of manuals for use during inspection, testing, and commissioning.

BCH must approve the settings and timing applied to overcurrent and power quality protection relays.

The DG owner has full responsibility for commissioning and periodic maintenance of the interconnection equipment. Commissioning and maintenance must be performed by competent personnel from the DG owner or a recognized service consultant. A copy of the commissioning and maintenance test reports signed by the person in charge shall be retained by the DG owner.

All electrical equipment in the DG System shall be certified and approved by the appropriate regulatory agency.

4.2 Type Testing

All inverters shall be certified to CSA Standard 107.1-01, Section 15, or be demonstrated to meet the anti-islanding test in CSA 107.1-01 as part of another product certification standard.

4.3 Protection Function Testing

(i) If microprocessor-controlled protective functions are used, and production line testing has been done to verify conformance with 3.2.6, 3.2.7, and 3.2.8, then a repeat of the production line testing (subject to item (ii) below) in the field is not required. Recommended manufacturer commissioning testing is required,

(ii) The anti-islanding function shall be checked by operating a disconnecting means to verify that the DG System ceases to energize the Distribution System and does not energize the Distribution System for the required time delay after the disconnecting means is closed,

(iii) If batteries are used, verify that the protection settings are stored in non-volatile memory. Disconnection or removal of batteries for a minimum of 10 minutes without change of the protection settings is an acceptable method of demonstrating non-volatile memory,

(iv) Testing of the DG System, where required, shall include procedures to functionally test all protective elements up to and including cease to energize the Distribution System at the

point of DG System connection to the customer's internal wiring. Testing will verify all adjustable protective set points, if any, and relay/breaker trip timing, if any.

Any system that depends upon a battery for trip power shall be verified to be of fail safe design by disconnecting the battery and verifying that the system ceases to energize the Distribution System.

5.0 MAINTENANCE & OPERATION

The DG owner has full responsibility for routine maintenance of the DG System and shall keep maintenance records according to the equipment manufacturer recommendations and accepted industry standards, in particular CE Code Part 1, paragraph 2-300.

DG System protection function operation shall be verified according to the manufacturer's recommended schedule, or at least annually if there is no manufacturer recommendation. Operating the disconnecting means and verifying that the DG System automatically ceases to energize the Distribution System and does not resume energizing until the Distribution System is Stabilized after the disconnecting means is closed is an acceptable verification method.

Failure to maintain CE Code and industry accepted maintenance standards can result in disconnection of the DG facility.

INFORMATIVE ANNEX A

SINGLE LINE DIAGRAMS FOR TYPICAL DG TECHNOLOGIES

FIGURE A-1: GRID-INTERACTIVE DG USING SOLAR PV, FUEL CELL OR DC-GENERATING WIND SYSTEMS

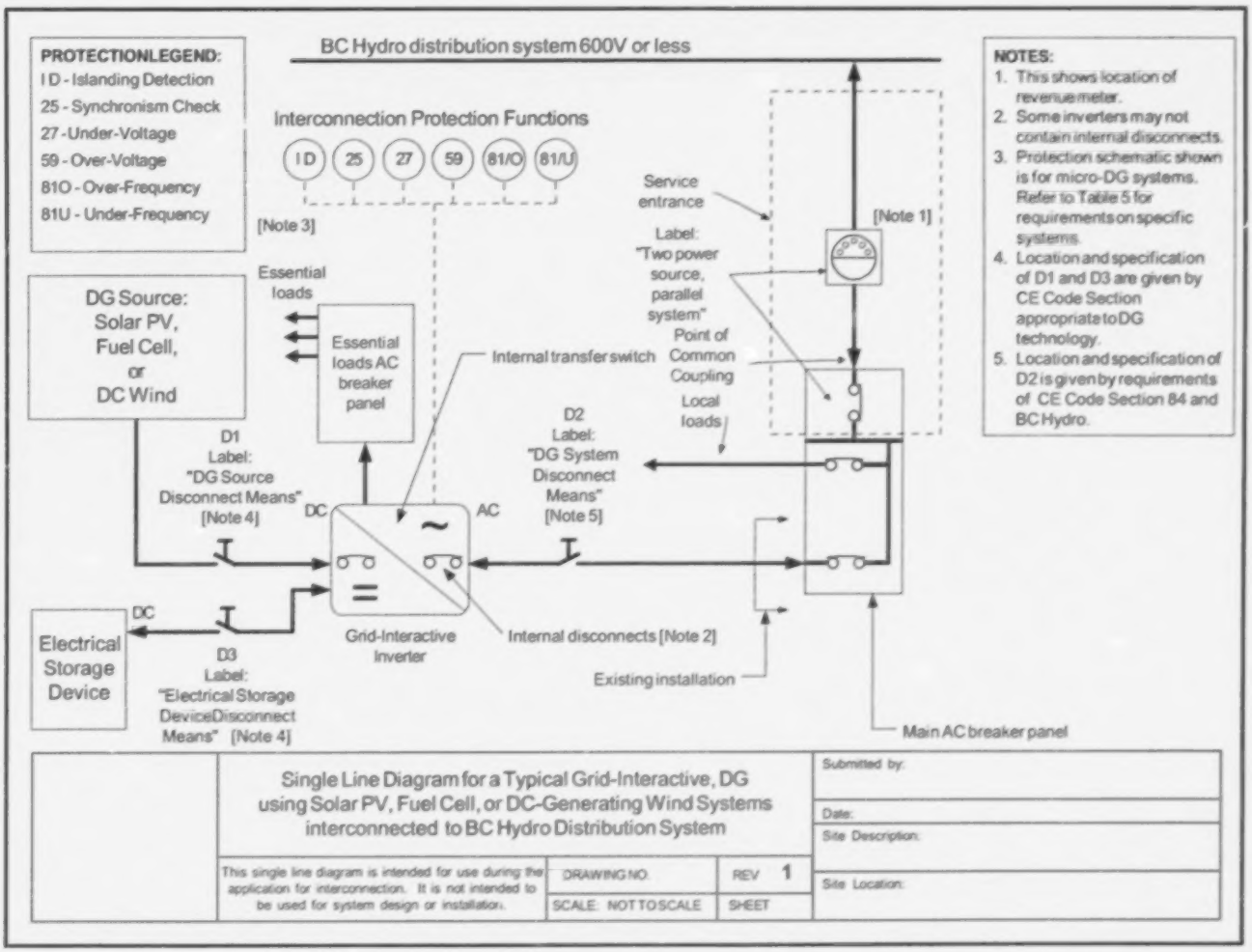


FIGURE A-2: DG USING INDUCTION OR SYNCHRONOUS GENERATORS

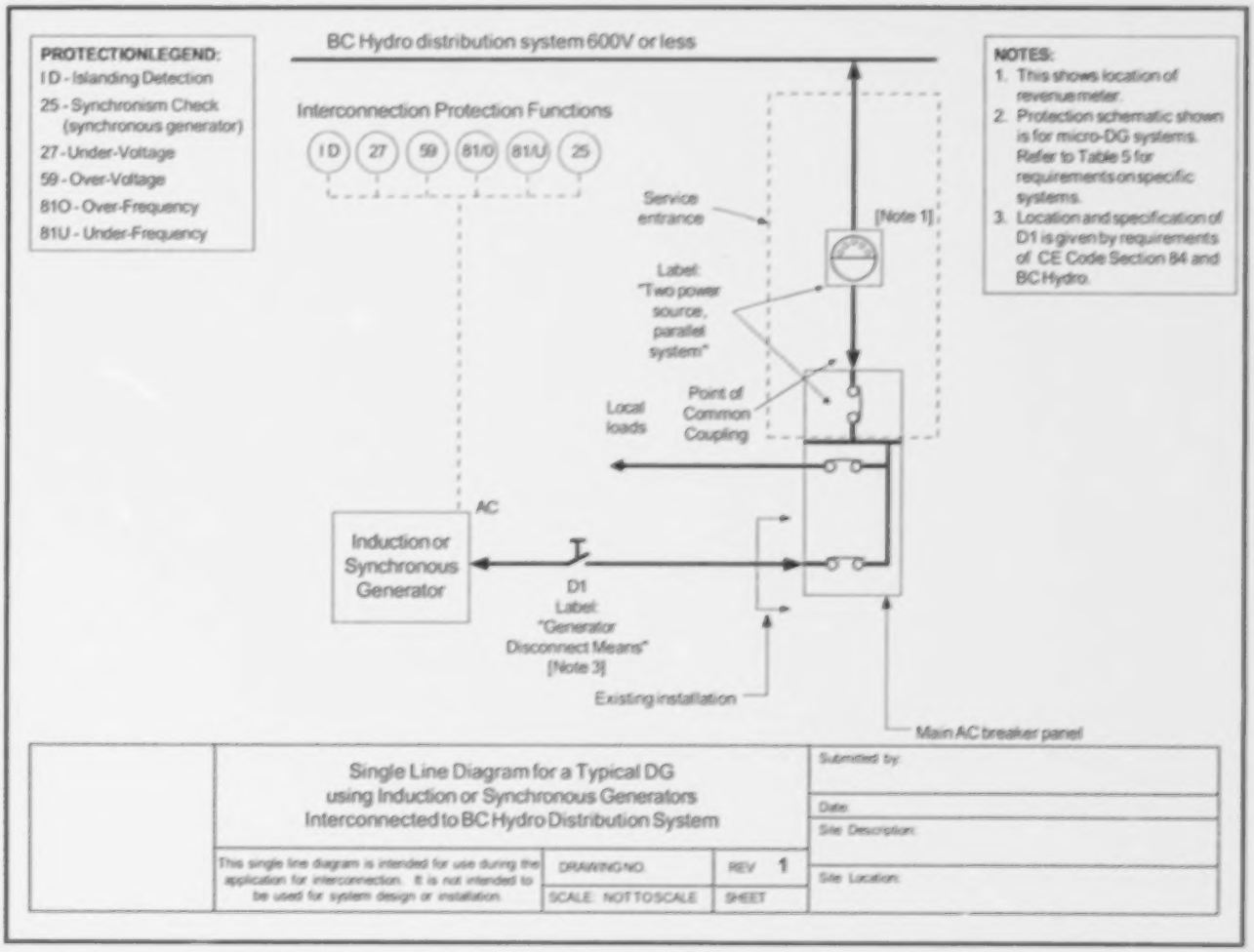
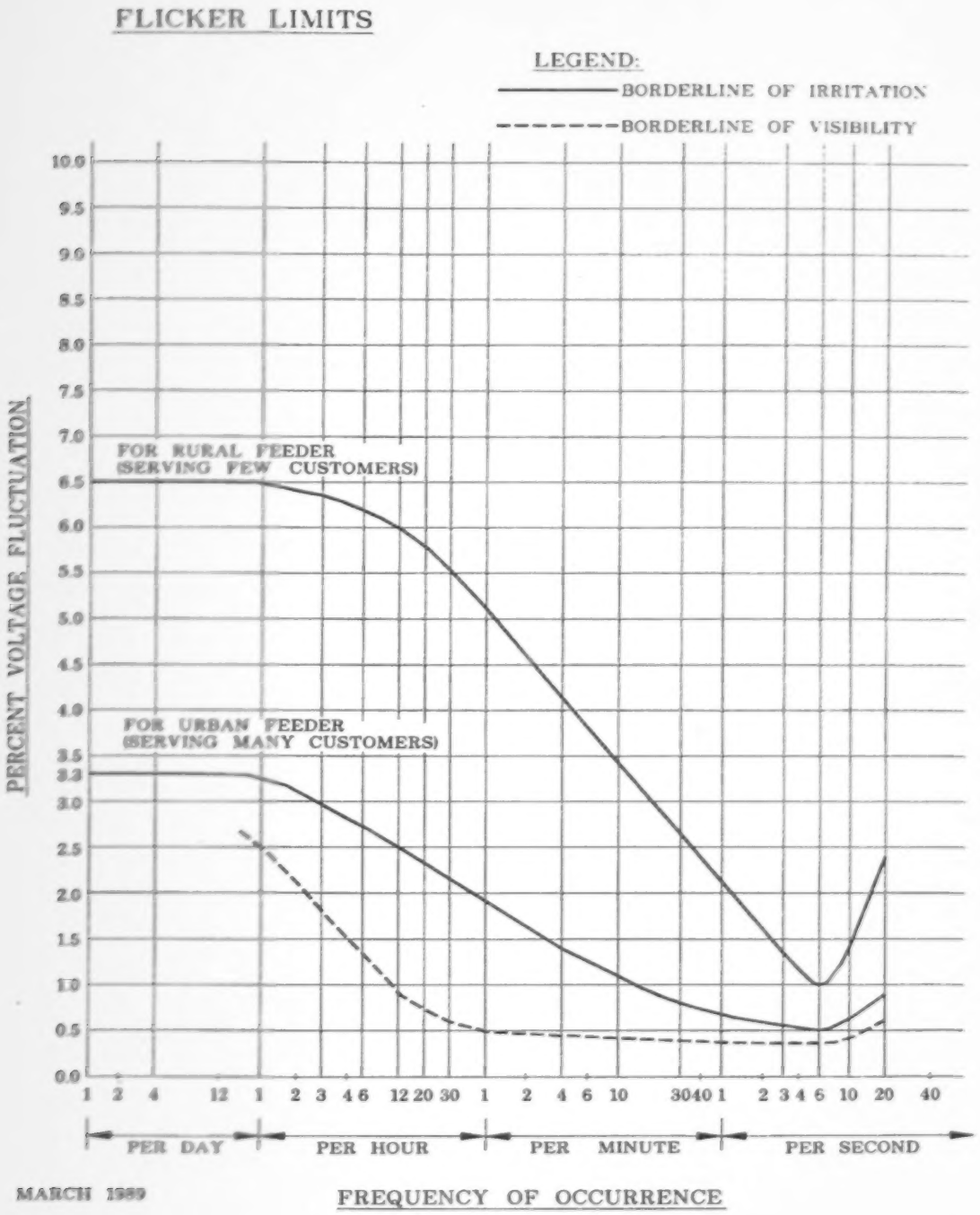


FIGURE A-3: BC HYDRO VOLTAGE FLICKER LIMITS



INFORMATIVE ANNEX B

INVERTER CLASSIFICATIONS AND OPERATING MODES

This informative annex is intended to provide a basic awareness of the types of inverters available and their operation.

B.1 Classification based on the dc link

Voltage source inverter: An inverter in which the dc link has a constant voltage, usually by way of a bank of capacitors, battery cells, or other electrical storage device.

Current source inverter: An inverter in which the dc link has a constant current, usually by way of an inductor.

B.2 Classification based on method of commutation

Self-commutated inverter: An inverter in which its semiconductor devices such as transistors, IGBTs, MOSFETs, GTOs and thyristors can be turned off by their own control circuits or auxiliary circuits. Most grid-connected inverters are self-commutated. Also known as a forced-commutated inverter.

Line-commutated inverter: An inverter in which its semiconductor devices, such as thyristors, are turned off with the help of an external source. Most line-commutated inverters are current controlled.

Load-commutated inverter: An inverter in which its semiconductor devices, such as thyristors, are turned off with the help of a load such as a synchronous motor.

B.3 Classification based on the output control

Voltage controlled inverter: An inverter that directly controls its voltage output.

Current controlled inverter: An inverter that directly controls its current output: waveform, magnitude and phase angle. Most grid-connected inverters and small inverters are of this type.

B.4 Classification based on the output waveforms

Sinusoidal wave inverter: An inverter that has a sinusoidal- output waveform.

Square wave inverter: An inverter that has a periodic square wave output, 180 degrees positive followed by 180 degrees negative.

Modified sine wave inverter: An inverter that has a periodic quasi-square wave output, usually 120 degrees positive, 60 degrees zero, 120 degrees negative, 60 degrees zero.

Voltage-following inverter: An inverter that operates in voltage-following mode.

B.5 Classification based on relationship to utility interconnection

The following modes can describe inverter operation:

a) ***Stand-alone mode***: in which an inverter operates in isolation from a Wires Owner's distribution facility, and generates its own voltage, phase, and frequency conditions.

b) ***Grid-parallel mode:*** in which an inverter operates in parallel with a Wires Owner's distribution facility and contains provision for synchronising its voltage, phase, and frequency to that facility.

c) ***Grid-dependent mode:*** in which an inverter operating in grid-parallel mode depends on a Wires Owner's distribution facility to initiate and maintain its operation.

Stand-alone inverter: An inverter that operates only in stand-alone mode and thus contains no facility to synchronise its output with a Wires Owner's distribution facility (can also be termed a grid-isolated inverter).

Grid-connected inverter: An inverter that is able to operate in grid-parallel mode. Also known as a grid-intertie or a grid-tied inverter.

Grid-dependent inverter: A type of grid-connected inverter that operates only in grid-dependent mode.

Grid-interactive inverter: A type of grid-connected inverter that is able to operate in both stand-alone and grid-parallel modes according to the availability of the Wires Owner distribution facility. It can be considered as a UPS that is also able to operate in grid-parallel mode. Note that this type of inverter initiates grid-parallel operation.

B.6 Classification based on the number of output phases

Single-phase inverter: An inverter that generates a single-phase electrical output.

Three-phase inverter: An inverter that generates a three phase electrical output. Also known as a polyphase inverter.